A PROGRAMME FOR GORSE CONTROL IN FORESTRY USING A DOUBLE KILL SPRAY REGIME

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Summary

Following successful small-plot trials in Canterbury a public forestry enterprise developed the technique of a double kill-spray, after burning as a means of clearing gorse (*Ulex europaeus*) from planting sites prior to establishment of radiata pine (*Pinus radiata*). This was compared with the then conventional single kill-spray, post-burn, option. The first spray was applied after a spring burn when regrowth was around 5 - 7 cm tall and the second spray just prior to the onset of winter following the emergence of fresh seedling and some coppice regrowth in the autumn. The double kill-spray technique reduced seedling establishment over the following 4 years by 90 - 95% compared to the conventional single spray system.

INTRODUCTION

Gorse is very difficult to eradicate with a single application of a herbicide. There is general agreement, in the forestry sector, that a combination of methods is essential - usually some form of crushing, followed by burning, followed by herbicide treatment of seedling and coppice regrowth (Chavasse and Davenport 1973a, b), but it is impossible to get a 100% kill of seedlings and coppice emergence after a burn, it is clear that a double kill-spray regime after burning is essential.

OBJECTIVES IN FORESTRY

In order to establish a fast-growing exotic forest, it is necessary to control competing vegetation. For most weeds, control needs to extend only through the establishment phase, which may be one growing season on some sites, and up to 3 years on others. From then on the trees dominate other vegetation to the extent that access for pruning and thinning some 4 to 7 years after planting is reasonably free. On sites where gorse is present before site preparation, this is not the case. Regrowth from seeds and coppice from the root crowns will compete severely with growing trees and, because gorse will tolerate shading (Zabkiewicz 1976), growth can continue under a tree canopy for several years. It can so obstruct access for pruning and thinning, for at least the first operation, that management costs may be increased by 20 - 60%. In addition, gorse is an aggressive competitor causing such variation in growth and tree form that silvicultural management is greatly complicated and the rotation age increased (for as much as 5 to 7 years in Ashley Forest) thereby reducing profitability (Watt and Tustin 1976). Where stands are heavily thinned at an early stage, gorse will be rejuvenated and become a further obstruction to subsequent management programmes.

Moreover, if gorse continues to produce seed during most of the tree rotation, there will be massive regeneration after clearfelling thus making re-establishment difficult and perpetuating the problem. A gorse understorey is also a high fire hazard.

Gorse should, as far as possible, be eradicated before forest crops are planted (Chavasse 1976), since there is no effective way of keeping it under control after planting. Profitable afforestation depends, in part, upon cheap but effective land preparation and establishment, fast initial growth and access for subsequent tending.

Evidence has now accumulated that two applications of 2,4,5-T in sequence after a burn can result in adequate control of gorse, at least for several years. Small plot

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trials were established in 1971 and 1972 in North Canterbury and the results of this work were most encouraging. It has been shown that eradication by a double kill-spray regime after burning is cheaper than any other option, when the whole costs and returns of the crop are taken into account (unpublished data, available on request).

METHOD

The timing of the treatment and rates of chemicals used are outlined in Table 1 and these are compared with the standard single kill-spray plus release-spray regime used by the Selwyn Plantation Board (SPB) for dealing with gorse.

TABLE 1: Detailed comparison of treatments and timing of the standard single kill plus release-spray establishment regime of the SPB, with the double kill-spray FRI regime

REGIME A Double kill-spray regime (FRI)		REGIME B Single kill/release-spray regime (SPB)	
Month/yr	Treatment	Month/yr	Treatment
Oct 1974	Burn	Oct 1974	Burn
Jan 1975	Spray 2.0 kg/ha 2,4,5-T iso-octyl ester and 0.5 kg/ha picloram as a potassium salt		
Mar 1975	Rip	Mar 1975	Rip
May 1975	Spray 3.6 kg/ha 2,4,5-T iso-octyl ester	May 1975	Spray 3.0 kg/ha 2,4,5-T iso-octyl ester and 0.75 kg/ha picloram as a potassium salt
June/July	Plant with 1½/0 radiata pine	June/July	Plant with 1½/0 radiata pine
		Oct 1975	Release spray 1.0 kg/ha 2,4,5-T iso-octyl ester

The area treated was in the Mt Lomond hills behind Glentunnel in Canterbury. A 10 ha block was treated by the usual SPB regime while the remaining 50 ha were prepared for planting using the double kill-spray regime. Spraying was undertaken with the use of a Hughes 300C helicopter; forward speed 70 km/hour; flying height approximately 9.5m; pump pressure 275 kPa. The 7.6 m boom was fitted with 39 D8/46 nozzles giving an effective swath width of 10.3 m. Droplet VMD 560 µl. A total volume of 220 litres/ha was applied in a double pass.

TABLE 2: Percentage of 1m² plots with gorse present 1, 2, 3, 4 and 5 years after site preparation

Date of assessment	Double kill regime % with gorse	Single kill/release regime % with gorse
April 1976	1.6	35.1
April 1977	1.8	42.1
April 1978	2.7	64.4
April 1979	5.6	85.7
February 1980	8.9	96.3

RESULTS

The relative success of the two regimes detailed in Table 1 is shown in Table 2. To obtain this information a series of line transects were laid down. At 4 m intervals a 1 m² grid was laid down alternately to the left or right of the transect line and a simple count was made to determine the presence or absence of gorse. A total of 1000 points were sampled and demarcated so they could be re-assessed over a number of years. Sampling intensity and areas to be sampled were predetermined from aerial photographs; transects were positioned on the photographs prior to location in the field.

Of the 50 ha block treated with the double kill-spray regime only 10 ha were sampled and the results given in Table 2 are considered to be representative of the whole block.

It is apparent that while the double kill-spray regime did not result in total eradication of gorse, the amount of regrowth is negligible compared with the alternative approach. All the differences were significant at below the 0.01 probability level using the chi-square test.

What gorse was present was very stunted, i.e., 30 cm tall with an occasional stem up to 70 cm tall. A follow-up treatment with a knapsack sprayer would result in near total eradication. On the areas where the single kill/release-spray regime was used the gorse was generally over 1.5 m tall and was becoming impenetrable.

DISCUSSION

Importance of the burn

The "burning off" of the existing gorse cover is a particularly important operation. An indifferent burn will produce an indifferent end-result and lead to inadequate control of the gorse. Hence sound planning and fuel preparation for burning is vital. Burning alone tends to leave stems standing which, in addition to forming a physical barrier to planting, also intercepts herbicides before they reach the target of green regrowth near the ground surface.

Although a satisfactory clean-up of "stick" can usually be obtained after a pre-burn desiccant spray, the best and most certain method is to crush green gorse before burning. Combinations of spraying and burning alone (without crushing) have proved more or less unsuccessful, partly because of the difficulty of obtaining a hot clean burn. However, the utilisation of more recent information (Balneaves 1978) on timing of application of herbicides in relation to seasonal growth stages of the mature gorse plant has resulted in greater stem kill and lower stem moisture content of standing gorse. This, coupled with better information on requirements for burning (number of days since rain, ambient temperature, and relative humidity) and a vastly improved "lighting-up" technique, has assisted in achieving more successful burning operations without crushing. Nevertheless crushing is still the better method for preparation of gorse fuels for burning. Crushing allows a hot, easily controlled, ground fire which not only consumes the woody material, but also kills many root crowns and destroys considerable quantities of seed in the upper level of the soil. When gorse fuels are prepared in this way, burning can be done within a few weeks with a high degree of success, whereas desiccation has to be undertaken 3 - 15 months before burning (Anstey 1976). A hot burn which consumes virtually all surface debris, including duff and weeds, stimulates rapid germination of seed in the ground (Zabkiewicz 1976) making it possible to obtain a good clean-up of regeneration with herbicides.

Why two post-burn applications prior to planting?

Gorse regeneration occurs first within 4 - 8 weeks of a burn depending on water uptake and soil temperature, with a further peak of germination of seedlings 9 - 12 months later. Subsequent emergence of further gorse regeneration is usually extremely limited or, where a good grass sward has developed in the 13 - 14 months after burning, it may not occur at all. Therefore, we should plan our operations to take advantage of these ecological facts.

The first post-burn herbicide application must be made when copice regrowth is around 7 cm tall and is still soft and leafy. At this stage seedling regeneration is usually prolific and has entered the soft expanding stage of development.

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In Canterbury the second spray application should be made just prior to the onset of winter, that is just prior to tree planting. Usually there is little material to be dealt with but if the spraying is not done then it will have to be left until later when either the gorse will be hard making sprays less effective or, if it is left until the spring flush, the gorse plants may be masked to some extent by grasses, again reducing the effectiveness for the spray operation.

A PRESCRIPTION FOR GORSE CONTROL IN FORESTRY OPERATIONS

To maximise control of gorse in forestry operations the following regime has been devised, tested, and recommended (N.Z. Forest Service, 1976: pp. 13 - 15). Some modifications have been made to the original recommendations in the light of further experience.

Step 1	Crush	Pre-burn spray is an alternative using 2,4,5-T iso-octyl ester at 3.4 kg/ha and 0.85 kg/ha picloram.
Step 2	Burn	
Step 3	Spray	Use 2,4,5-T iso-octyl ester at 3.0 kg/ha and 0.75 kg/ha picloram. Gorse regrowth should be only 5 - 7 cm tall and/or in the soft expanding stage of growth.
Step 4	Spray	Use 2,4,5-T iso-octyl ester at 5.4 kg/ha.

The timing of spray operations needs some "fine tuning" for optimum results, in relation to the growth stage of gorse and to local climatic factors, but the principles will remain valid.

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